



IN THE U.S. PATENT AND TRADEMARK OFFICE

APPLICANT: Kazuaki SUMITA et al.
SERIAL NO.: 10/618,765
FILED: July 15, 2003
FOR: Liquid Epoxy Resin Composition and
Semiconductor Device
GROUP: 1712
EXAMINER: SELLERS, ROBERT E

D E C L A R A T I O N

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir,

I, Kazuaki SUMITA, resident of c/o
Silicone-Electronics Materials Research Center,
Shin-Etsu Chemical Co., Ltd., 1-10, Oaza Hitomi,
Matsuida-machi, Usui-gun, Gunma-ken, Japan do hereby
declare that:

1. I was graduated from Master Course of the
Department of Material and Applied Chemistry of Nihon

University, Japan in March, 1992. Since 1992, I have been employed by Shin-Etsu Chemical Co., Ltd., the assignee of the above-identified application. I have been engaged in research and development relating to organic material in the laboratory of the Company.

2. I am one of the named inventors of the above-identified application and hence, am familiar with the subject matter disclosed in said application.

3. In order to show the feature of the present invention, I conducted the following experiments.

[Experiments]

The components shown in Table A were mixed to uniformity on a three-roll mill to give liquid epoxy resin compositions. These compositions were examined by the tests described in the specification of the above-identified application. The results are also shown in Table A. The result of Example 1 of the specification is also shown.

Table A

Component (pbw)		Example						Comparative Example			
		1	6	7	8	9	10	11	4	5	6
C-100S		30							27		30
Kayahard AA			35	32	29	35	32	29		27	
RE303S-L		70	65	68	71	65	68	71	72	73	70
Spherical silica		150	150	150	150	150	150	150	150	150	150
KBM403											1.0
Copolymer		4	4	4	4	0	0	0	4	4	4
Epoxy resin/amine curing agent molar ratio		0.8	0.7	0.8	0.9	0.7	0.8	0.9	1.0	1.0	0.8
Measurement results											
Viscosity at 25°C (Pa·s)		75.6	22.0	20.5	19.4	14.6	13.1	12.2	66.8	12.4	68.5
Void test		nil	nil	nil	nil	nil	nil	nil	nil	nil	voids
Toughness K _{Ic} (MPam ^{1/2})		4.3	3.9	4.2	4.1	3.8	4.0	3.8	3.3	3.4	4.4
Tg (°C)		125	102	102	106	102	103	105	139	110	125
CTE-1 (ppm/°C)		32	32	32	32	32	31	32	29	32	32
CTE-2 (ppm/°C)		122	116	114	113	115	116	116	110	115	117
PCT peel test	After 5 times of IR reflow at 265°C	no peeling	no peeling	no peeling	no peeling	no peeling	no peeling	no peeling	no peeling	no peeling	no peeling
	After PCT 336 hr	no peeling	no peeling	no peeling	no peeling	no peeling	no peeling	no peeling	no peeling	no peeling	no peeling
Bond strength (kgf/cm ²)	Initial	256	229	231	235	215	221	233	205	215	241
	After PCT 336 hr	206	175	172	199	184	179	196	121	154	195
Failure (%) after thermal shock test	250 cycles	0	0	0	0	0	0	0	0	0	0
	500 cycles	0	0	0	0	0	0	0	0	0	0
	750 cycles	0	0	0	0	0	0	0	5	5	0

Components:

C-100S: diethyldiaminophenylmethane, Nippon Kayaku Co., Ltd.

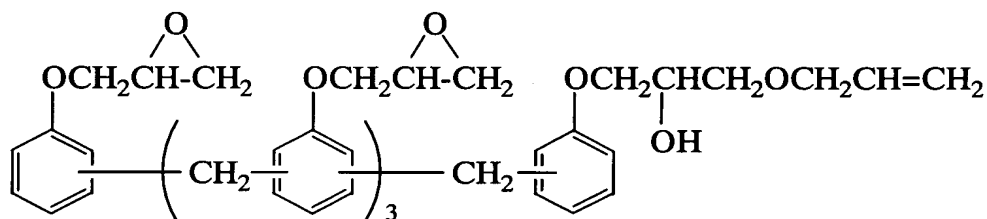
kayahard AA: Formaldehyde, polymer with 2-ethylbenzen-amino, Nippon Kayaku Co., Ltd.

RE303S-L: bisphenol F-type epoxy resin, Nippon Kayaku Co., Ltd.

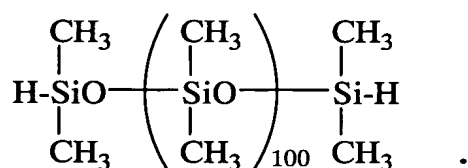
KBM403: silane coupling agent, γ -glycidoxypentyltrimethoxysilane, Shin-Etsu Chemical Co., Ltd.

Spherical silica: spherical silica having a maximum particle size of up to 24 μm and an average particle size of 6 μm

Copolymer: the addition reaction product of



and



I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated this 6th day of January, 2006

A handwritten signature in black ink, appearing to be "K. S. [unclear]", written over a horizontal line.